Chapter 2
Types of Prefabricated Construction

2-1. Introduction

a. Prefabrication methods of construction involve some degree of assembling or fabrication of components at a location other than their permanent location. This is commonly done for many project components. Many large components are delivered to their permanent site in some state of completion. For example, steel tainter gates have been partially assembled offsite and then completed at their permanent location. Also serving as a precedent for prefabricated construction methods are precast concrete shell-like barges, docks, dry docks, offshore platforms, tunnels, floating approach walls, etc. Large sections can be made using segmental construction to connect precast concrete panels with bolts, closure pours of concrete, stressing cables, or some combination of each. In situ work would be performed to prepare the foundations in-the-wet, connect the superstructure to the foundations, and complete the monoliths. Various concrete components for navigation projects can be made of precast concrete construction that are either built near the site or built offsite and transported to their final destination.

b. Transportation may be by barge or the unit may itself float. Coast Guard classification may be needed for floating units. Transportation and access routes should be planned and restrictions researched. En-route mooring areas should be established. Towing of a unit over long distances will probably not be initiated until a reliable weather forecast is available for the whole journey or to the next mooring point. Contingency plans for transportation mishaps should be developed. Such plans can include redundant towing anchor points or fittings, en-route mooring facilities, locking priorities (if applicable), standby towboats, etc. Sizes of prefabricated components may be controlled by the size of locks en route, draft restrictions (mussel beds, river depth, or other), bridge clearances, powerline clearances, foundation type and strength, monolith size and strength, stability requirements, space for operating equipment, and constraints created by existing project features, if any. During some stages of construction/fabrication, truck or rail transportation may be useful. The equipment that transports the units may also be restricted by existing infrastructure.

c. In general, these construction methods reduce in situ construction time. They offer parallel construction of the foundation structure or substructure and the superstructure.

2-2. Construction Methods

The various construction methods in this circular can be categorized into one of the following: Float-in, Heavy Lift-in, Light Lift-in, or Combinations of Construction Methods. Descriptions of these lock construction methods, including traditional construction for purposes of comparison, are provided below.

a. Traditional, in-the-dry construction. This construction method refers to the traditional manner of constructing a Corps of Engineers navigation project at its permanent location inside a dewatered cofferdam. Most monolith-type construction is conducted in situ using cast-in-place concrete and conventional formwork. Cofferdams are relatively time consuming and costly to construct and dictate dependency of certain construction activities. The start of onsite construction of a navigation structure is dependent on full completion of the cofferdam. Similarly for monolith construction, the placement of formwork, rebar, and concrete is dependent on the completion of foundation work. Most cofferdams require partial or full removal upon completion of the project.

b. Float-in construction. Float-in construction consists of the prefabrication of very large (entire monoliths or multiple monoliths) precast concrete shells that are built offsite and floated to their

permanent location. Offsite fabrication can range from being nearby the construction area or a great distance away. The shells usually float either by themselves or with the aid of external pontoon-like flotation devices. The shells are positioned for attachment to their foundations and lowered through the water by ballasting which can be controlled with vertical restraining forces (referred to as negative buoyancy) provided from large cranes, winches, or other machinery. The foundations are prepared in-the-wet. Once positioned, there is usually a void to fill between the bottom of the shell and the top of the foundation bed. This void is commonly filled with grout or sand (although other materials such as bentonite may be usable) depending on design needs such as bearing, seepage cutoff, bond of piles to the shell, etc. The shells act as stay-in-place forms for fill concrete. Large cranes for handling the units, floating plant for transport and installation, and marine facilities are critical items for this method of construction. Also, a site is required for prefabrication of the components. Components can be outfitted with features required for construction, such as, grout pipes, working platforms, temporary bulkheads to add buoyancy, pile wells or driving templates, skirts for underbase grout containment, electrical wiring/ducts, access/inspection ports, leveling jacks, instrumentation to assist placing, etc.

c. Heavy lift-in construction (greater than 500 tons). Heavy lift-in construction consists of the prefabrication of very large precast concrete shells that form parts of monoliths or entire monoliths. The size of the units requires that they be handled with large marine cranes. Temporary flotation chambers within the components can reduce the effective weight by increasing buoyancy if required. They are built away from their permanent location and transported by barges to their permanent location. A remote precast yard or onsite facilities are possible locations to fabricate these units. These facilities are key aspects of the project. At their permanent location, the shells are lifted into place by a crane(s) onto their foundations. Pile foundations can either be predriven piles or, alternatively, piles can be driven through the shell while it is temporarily supported on pads or by support piles. The units are subsequently filled with concrete to connect them to the piles or to bedrock. Units can be outfitted similarly to float-in components as discussed in subparagraph *b* above.

d. Light lift-in construction (less than 500 tons). This method uses construction equipment that is smaller than that for heavy lift-in. Usually pieces are made lighter and smaller to accommodate more standard equipment or different needs/features of individual projects. A remote precast yard or onsite facilities are possible locations to fabricate these units. These facilities are smaller than for heavy lift-in, which could make them less of a problem. Generally, entire monoliths would not be placed in one crane pick. Multiple crane picks would be used to essentially construct a monolith in situ, although still in-the-wet. This method results in the connecting of more joints at the site and possibly under water.

e. Combinations of construction methods. Methods of construction can be combined. A component may be floated to a construction site under its own buoyancy. At the site, it may be set into place by a very large crane(s). Also, many small shells may be assembled into a much larger unit that is then floated to a construction site for installation. Individual elements may use offsite fabrication with near-site assembly or ballasting and in situ conventional construction (above water).